



Pinedale Anticline Record of Decision Ozone Compliance Plan

August 5, 2014

Record of Decision - Ozone

- The requirements for ozone are defined in Section 4.1.2 of the ROD:

To ensure that this project will result in the continued attainment of the Wyoming Ambient Air Quality Standards (WAAQS), within one year of the signing of this ROD, and as needed thereafter, BLM, WDEQ-AQD, and the Operators, with input from EPA, will refine the NO_x and VOC emissions inventory. BLM, in consultation with WDEQ-AQD and EPA, will ensure that new modeling conducted and funded by the Operators, includes all WDEQ BACT requirements and a sensitivity analysis to determine appropriate reductions in ozone precursor emissions. BLM, WDEQ-AQD, in consultation with EPA and the Operators, will evaluate the modeling results.

Record of Decision - Ozone

- ROD Section 4.1.2 (continued):

As soon as possible following evaluation of modeling results and if needed, the BLM and WDEQ-AQD, in consultation with EPA, will use their respective authorities to implement emission control strategies and/or operating limitations necessary to ensure compliance with applicable ambient air quality standards for ozone. Absent an effective technology to implement, reductions in the pace of development may be utilized to ensure ambient air quality standards are met.

Ozone Compliance Plan Overview

- ROD requirements for ozone
- Status of winter ozone
- Goal of the Ozone Compliance Plan
- Components of the Ozone Compliance Plan
- Summary of each component's findings
- Conclusions
- Next steps

ROD Requirements for Ozone

- Section 4.1.2 of the ROD requires:
 - *“...BLM, WDEQ-AQD, and the Operators, with input from EPA, will refine the NO_x and VOC emissions inventory”*
 - *“...new modeling conducted and funded by the Operators, includes all WDEQ BACT requirements and a sensitivity analysis to determine appropriate reductions in ozone precursor emissions”*
 - *“...the BLM and WDEQ-AQD, in consultation with EPA, will use their respective authorities to implement emission control strategies and/or operating limitations necessary to ensure compliance with applicable ambient air quality standards for ozone”*
 - *“...Absent an effective technology to implement, reductions in the pace of development may be utilized to ensure ambient air quality standards are met”*

ROD Requirements for Ozone

- The Ozone Compliance Plan (Plan) addresses the inventory refinements and associated emission reductions realized in the PAPA since 2008
- To date, photochemical grid models (PGMs) have proven ineffective for modeling wintertime ozone conditions in the UGRB
- The BLM provided direction (May 2011) that ozone modeling conducted for the ROD would only evaluate the months of April through December; WDEQ concurred

ROD Requirements for Ozone

- The Plan provides a detailed evaluation of ozone conditions during the non-winter months of April through December, which is defined as “summer”
- However, because of the importance of winter ozone, we provide an overview and status update of winter ozone levels, and the controls and practices implemented by the WDEQ and the Operators that are aimed at reducing winter ozone levels

Status of Winter Ozone

- Elevated 8-hour ozone greater than the WAAQS level of 75 parts per billion (ppb) was observed in the winter months of February and March in 2005, 2006, 2008, and 2011
- Winter ozone levels in 2007, 2009, 2010, 2012, 2013, and 2014 were below 75 ppb
- In response to ozone action day notices issued by WDEQ in response to weather conditions conducive for the formation of winter ozone, USQ initiates their respective contingency plans to reduce emissions
- No action days were called in 2013 or 2014; plans were initiated in response to a 2012 action day, and no elevated ozone was monitored

Status of Winter Ozone

- Prior to and since the non-attainment designation, WDEQ conducted several modeling studies to understand and characterize winter ozone in the UGRB
- Under a “marginal” non-attainment designation, the WDEQ is not required to conduct future modeling demonstrations to bring the area into attainment
- However, the WDEQ committed the resources to develop a PGM platform that was intended to simulate the conditions that lead to elevated winter ozone formation in the UGRB

Status of Winter Ozone

- Two models were configured and run (CAMx and CMAQ), and their performance was assessed against ambient ozone monitors
- Both models under-predicted the ozone levels at the Sublette County monitors where they were assessed
- WDEQ is evaluating next steps for the development of a winter ozone model

Status of Winter Ozone

- To improve their understanding of ozone precursor emissions, the WDEQ has initiated the collection of emissions data for use in improving the emission inventories, with voluntary participation by USQ, including:
 - A study of produced water tanks to research and quantify emissions from produced water tanks
 - A study to assess the control effectiveness of combustors, and to research and quantify fugitive emissions
- The Operators have continued to work proactively with WDEQ on strategies to reduce ozone precursor emissions

Status of Winter Ozone

- USQ complies with the most up to date requirements with every new permit or modified permit, including the State-wide permitting program for minor and major new and modified sources, and emission offsets
- Ongoing compliance with the regulations includes two full time WDEQ inspectors dedicated to the JPAD, one of which is funded by the Pinedale Anticline Monitoring and Mitigation Fund as administered by the Pinedale Anticline Project Office (PAPO)
- USQ has voluntarily applied for and obtained federally enforceable drill rig permits issued by the WDEQ that limit the allowable NO_x emissions

Status of Winter Ozone

- USQ is committed to continuing to:
 - Comply with the ROD and WDEQ Presumptive-BACT requirements
 - Pursue practical operational efficiencies
 - Respond to ozone action day notices on forecasted high ozone days by implementing their respective ozone contingency plans
 - Work collaboratively with WDEQ on policies to reduce precursor emissions
- The remainder of this presentation is on summer ozone and the ROD's modeling requirements

Goal of the Ozone Compliance Plan

- To demonstrate, using existing data sets and information, that the ozone modeling requirements contained in the ROD have been met
- Specifically, we present information obtained directly from modeling studies in the region, which serve as sensitivity analyses to changes in Sublette County emissions
- Additional information is included to better understand the role of oil and gas (O&G) emissions with respect to summer ozone

Components of the Ozone Compliance Plan

- Components of the Plan include:
 - The purpose of the Plan and the rationale for focusing on summer months
 - An assessment of regional ozone modeling studies that have been conducted, with a focus on the ROD's modeling requirements, and a summary of regional background in the Intermountain West
 - An assessment of Sublette County and regional summer ambient ozone concentrations compared to the WAAQS, qualitative and quantitative trend and correlation analyses
 - Presentation of Operator NO_x and VOC actual emission trends and reductions since the signing of the ROD

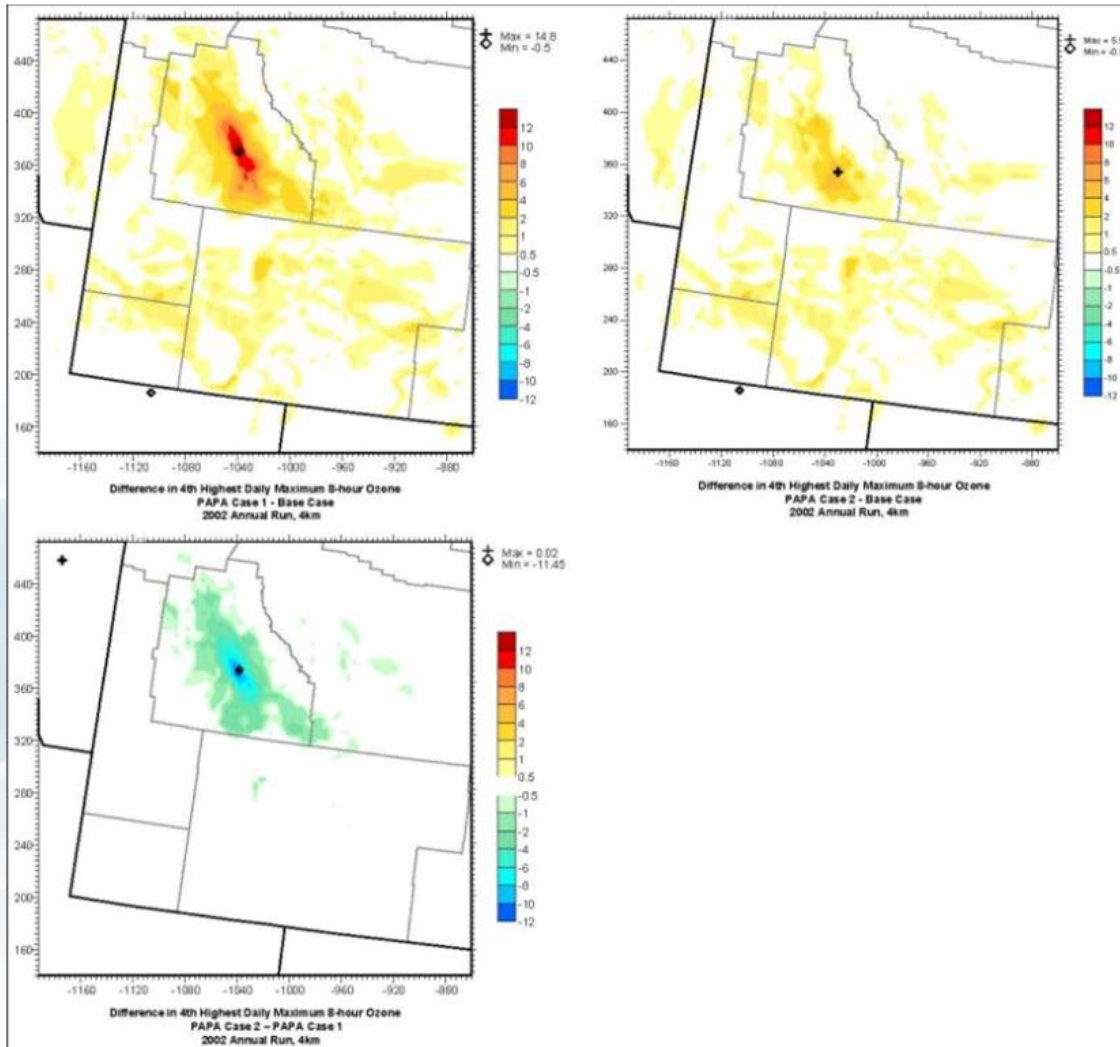
Summary of Findings - Modeling

- Four regional PGM studies were reviewed:
 1. Pinedale Draft SEIS CALGRID
 2. Pinedale Final SEIS CAMx
 3. Continental Divide – Creston (CD-C) Draft EIS CAMx
 4. WestJump Air Quality Modeling Study CAMx
- The first 3 studies were reviewed in the context of the ROD requirement for sensitivity analyses
- The 4th study provides source contribution analyses that are instructive for understanding the influences of background and O&G emissions on summer ozone in the UGRB

Summary of Findings - Modeling

- The Pinedale FSEIS and CD-C DEIS studies included future year emission levels for Sublette County that were much higher than the most recent actual emissions obtained from the county-wide WDEQ inventories
- From these studies, when ozone precursor emissions are reduced, whether only NO_x, or both NO_x and VOC, the CAMx model produces less ozone in Sublette County

Summary of Findings - Modeling

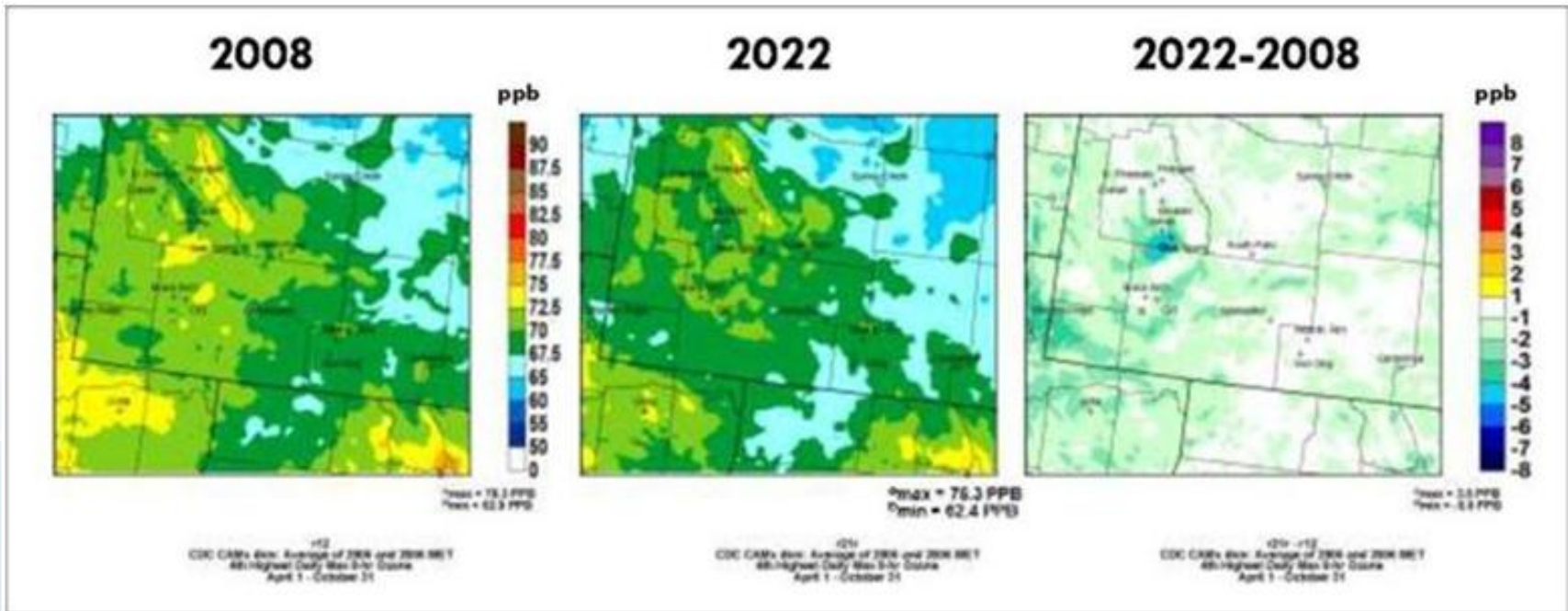


Pinedale FSEIS CAMx results for the two Project Alternatives that were modeled

Top right and lower left panels show that less ozone is formed with the lower NO_x emissions in the final Preferred Alternative

Figure source: BLM (2008b), Appendix H, Figure 4-4

Summary of Findings - Modeling



**CD-C DEIS CAMx results
for baseline and future
years**

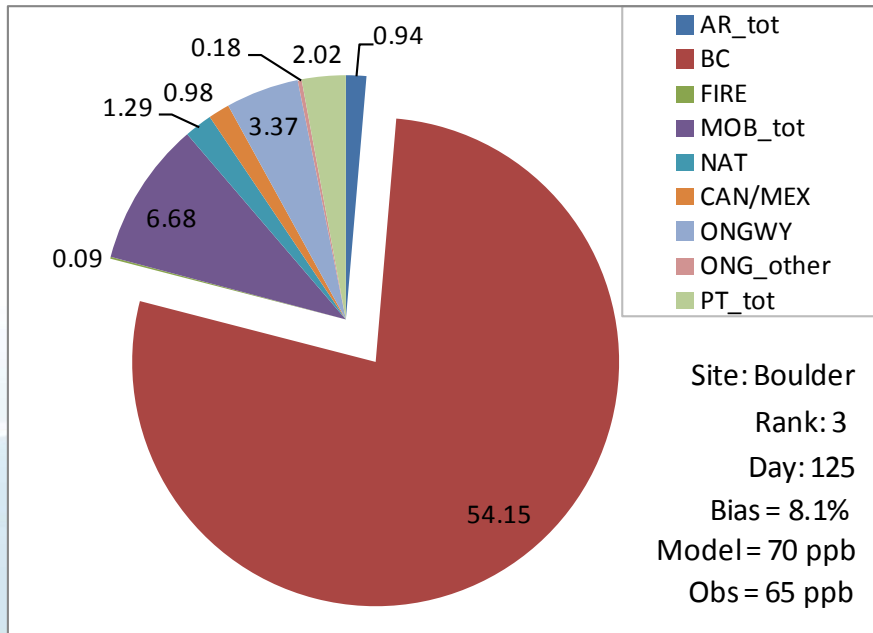
Figure source: BLM (2012), Figure 4-38

**Right panel shows that
less ozone is formed with
the lower NO_x and TOG
emissions in the 2022
future year**

Summary of Findings - Modeling

- The WestJump study showed that upstream O&G emissions contributed no more than 3.37 ppb (up to 5% of the total impact) when using comparatively high 2008 actual emissions vs. more recent actual emissions
- The WestJump study also showed that background ozone associated with international transport of precursor emissions and stratospheric ozone intrusion is the dominant mechanism for local ozone formation at Sublette County monitoring locations

Summary of Findings - Modeling

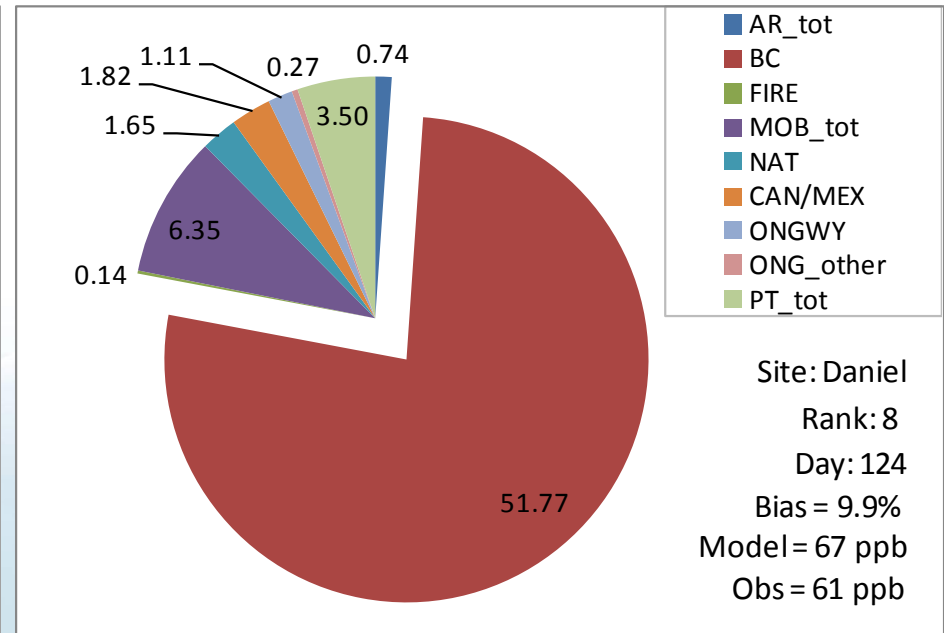


Boulder monitor's "worst-case" Wyoming O&G contribution day

Source group contributions in ppb

"ONGWY" = Wyoming O&G sources

"BC" = Boundary conditions (background ozone)



Daniel monitor's "worst-case" Wyoming O&G contribution day

Source group contributions in ppb

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Summary of Findings – Background Values

- Understanding North American (NA) background is a critical component when assessing ozone in the Intermountain West
- Three journal articles/publications were reviewed (EPA 2013, and two Zhang et al articles from 2011 and 2014)
- Elevated Intermountain West background summer ozone: high elevation, deep boundary layer mixing, large-scale subsidence, slow ozone deposition to the arid terrain, slow ozone chemical loss due to dry conditions, pollution sources outside the U.S., and stratospheric intrusion

Summary of Findings – Background Values

- The mean NA background values during the traditional spring-summer ozone season were estimated to be 40 ± 7 ppbv at high altitude locations (i.e., the Intermountain West) with the 4th highest NA background values between 50-60 ppbv

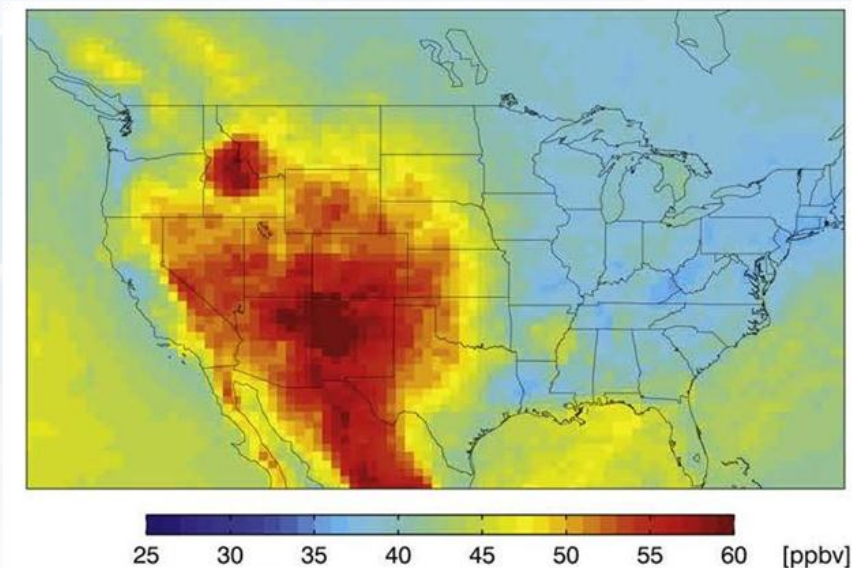
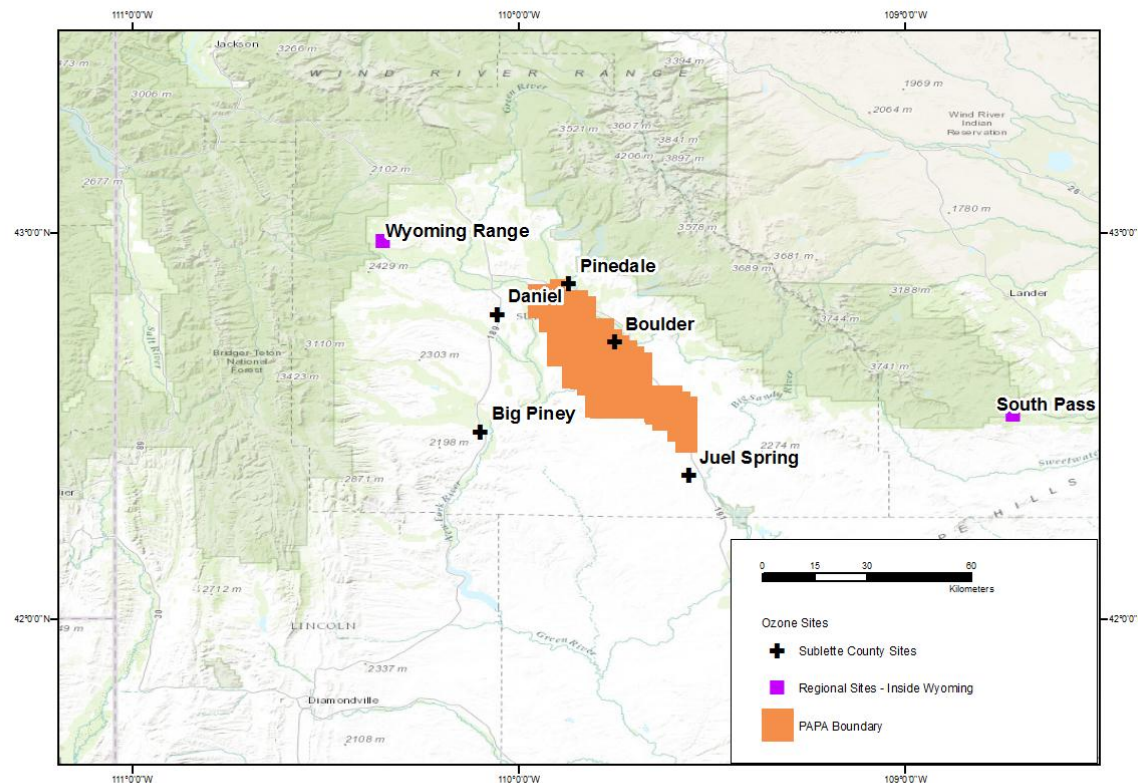


Figure source: Zhang et al (2011), Figure 7.

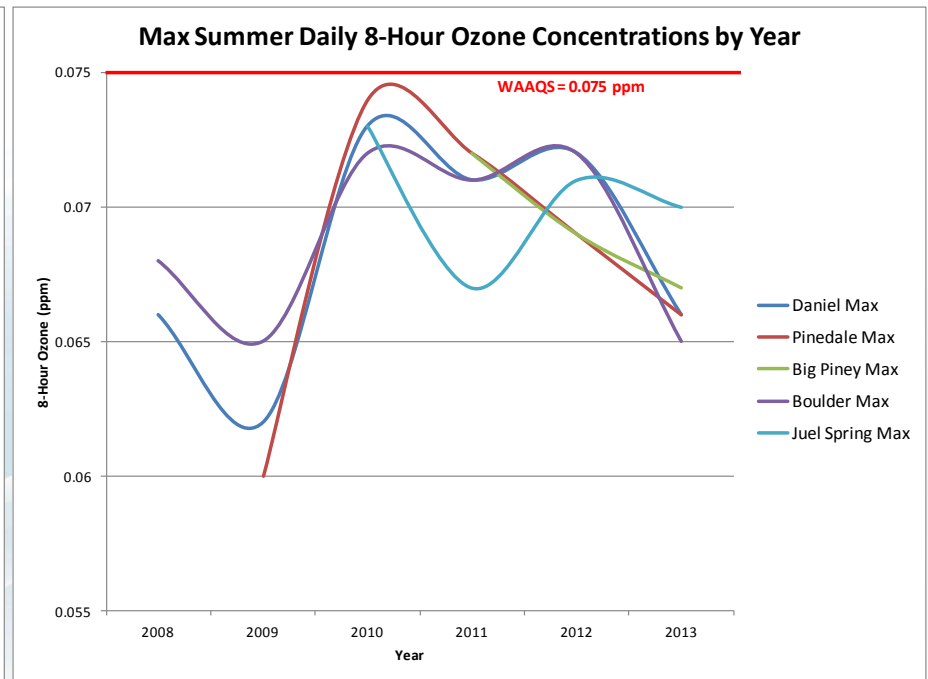
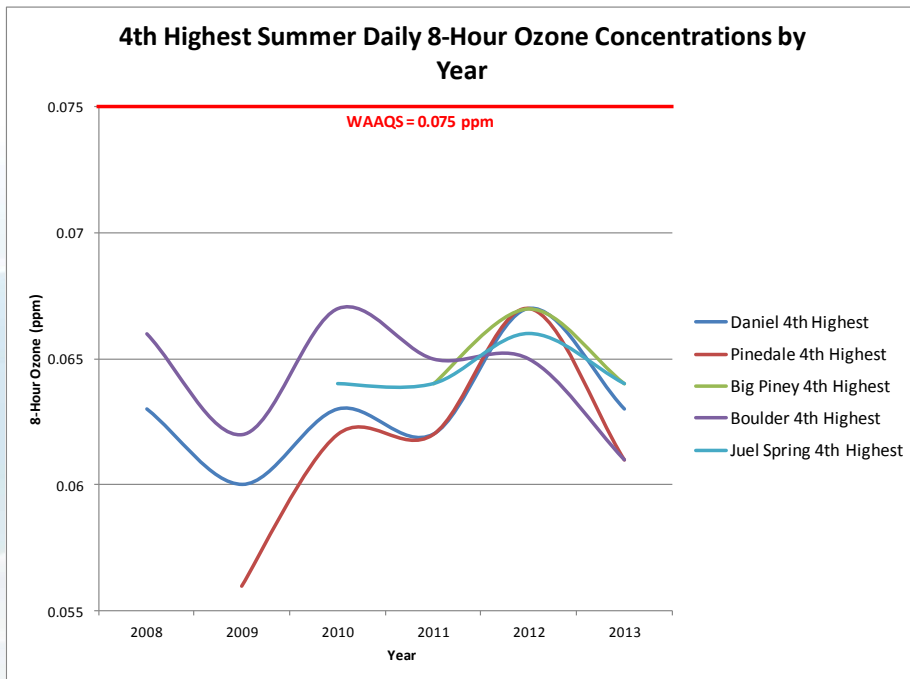
Summary of Findings – Summer Ozone Measurements

- Sublette County monitors evaluated



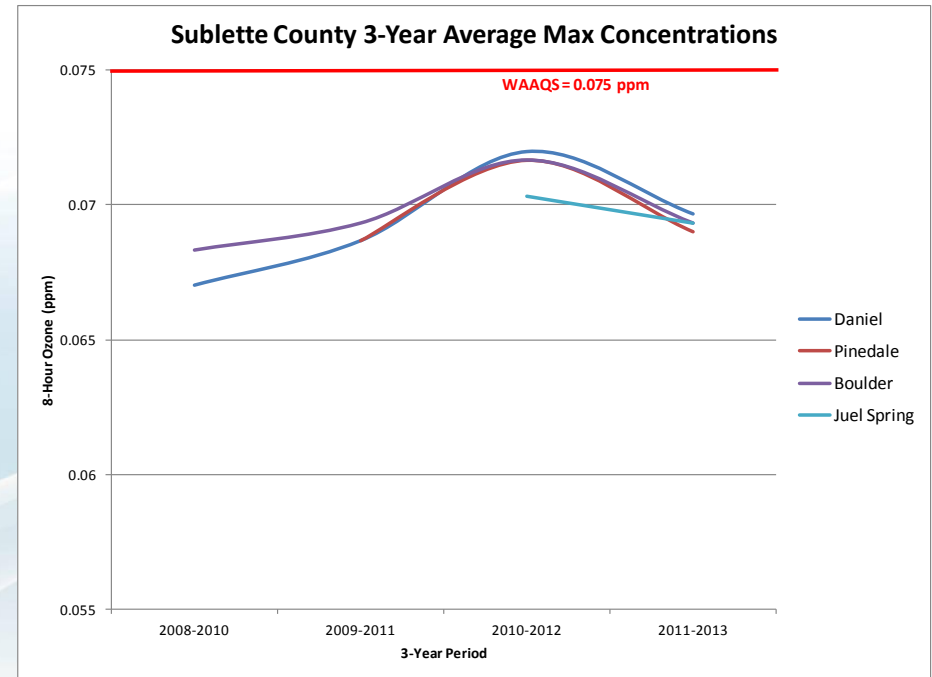
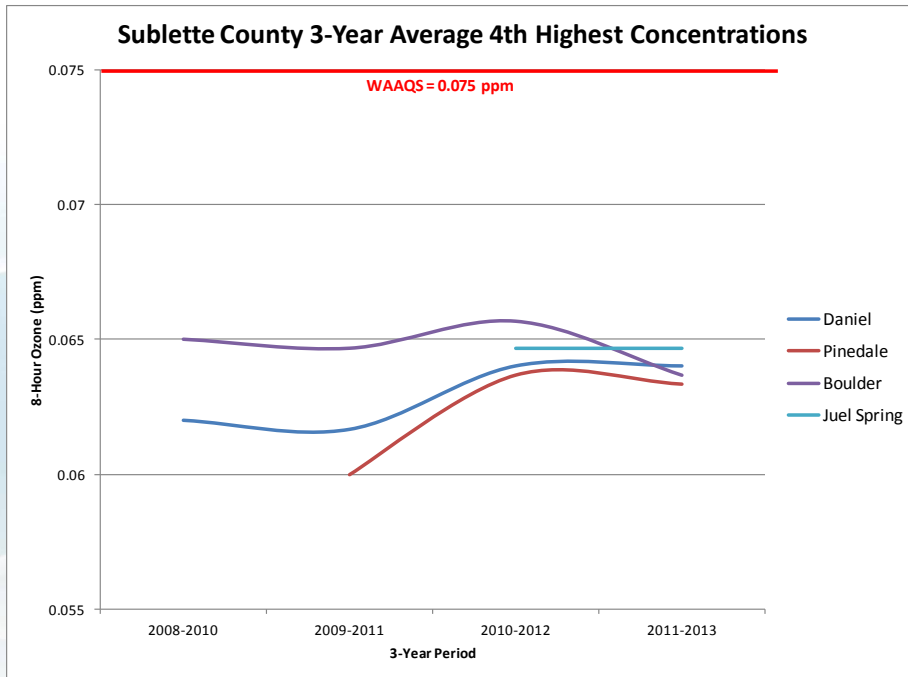
Summary of Findings – Summer Ozone Measurements

- Sublette County monitored max and 4th highest values are below 75 ppb



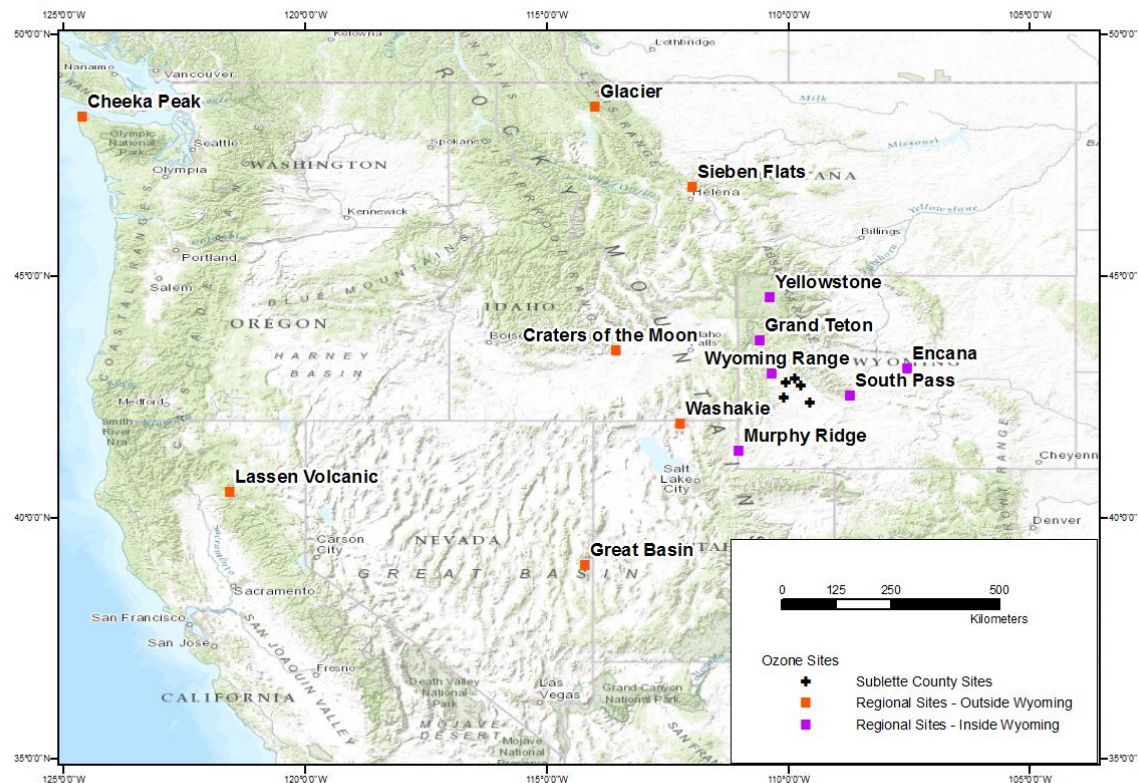
Summary of Findings – Summer Ozone Measurements

- Sublette County calculated 3-year averages of max and 4th highest values are below 75 ppb



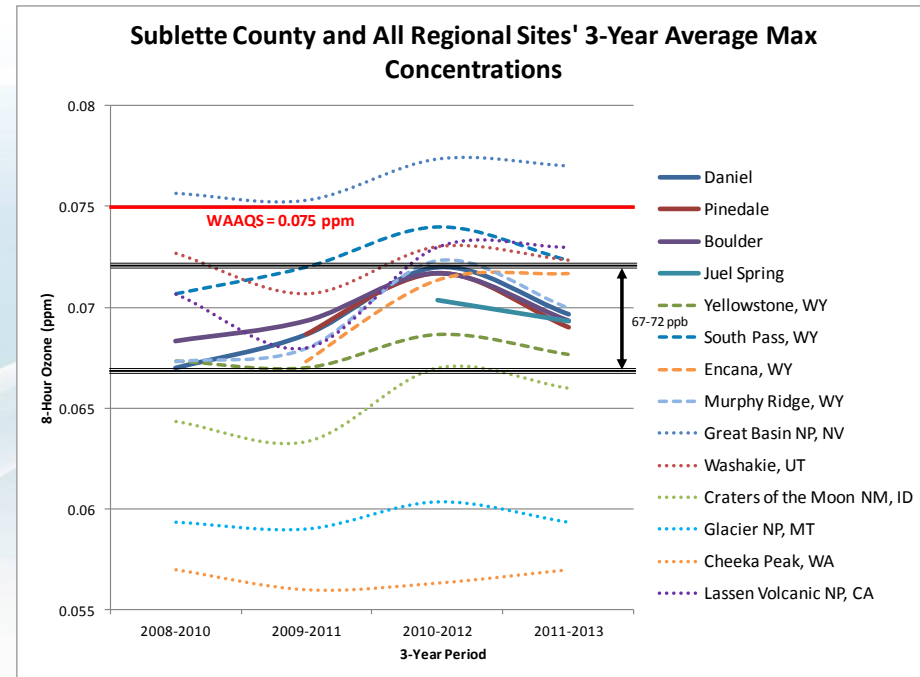
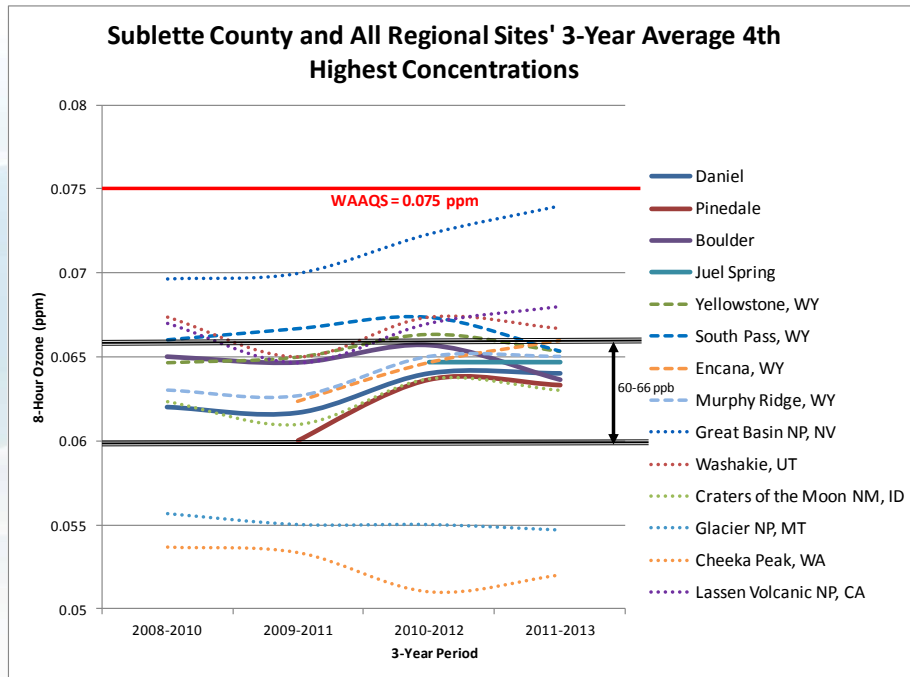
Summary of Findings – Summer Ozone Measurements

- Regional monitors evaluated



Summary of Findings – Summer Ozone Measurements

- The changes in 3-year avg ozone values throughout the period are similar for nearly all stations, and the majority of the regional stations had concentrations in the same range as the Sublette County monitors



Summary of Findings – Summer Ozone Measurements

- There were no statistically significant trends in the Sublette County, or WY regional, max or 4th highest 8-hour values; except Encana/Spring Creek had an increasing trend in the 4th highest values
- The only significant trend in the max or 4th highest values at the non-WY regional monitors was a downward trend in the 4th highest values at Glacier NP in Montana
- Statistically significant correlations were found between Sublette County and WY regional sites, but not for regional sites outside WY

Summary of Findings – Emission Reductions

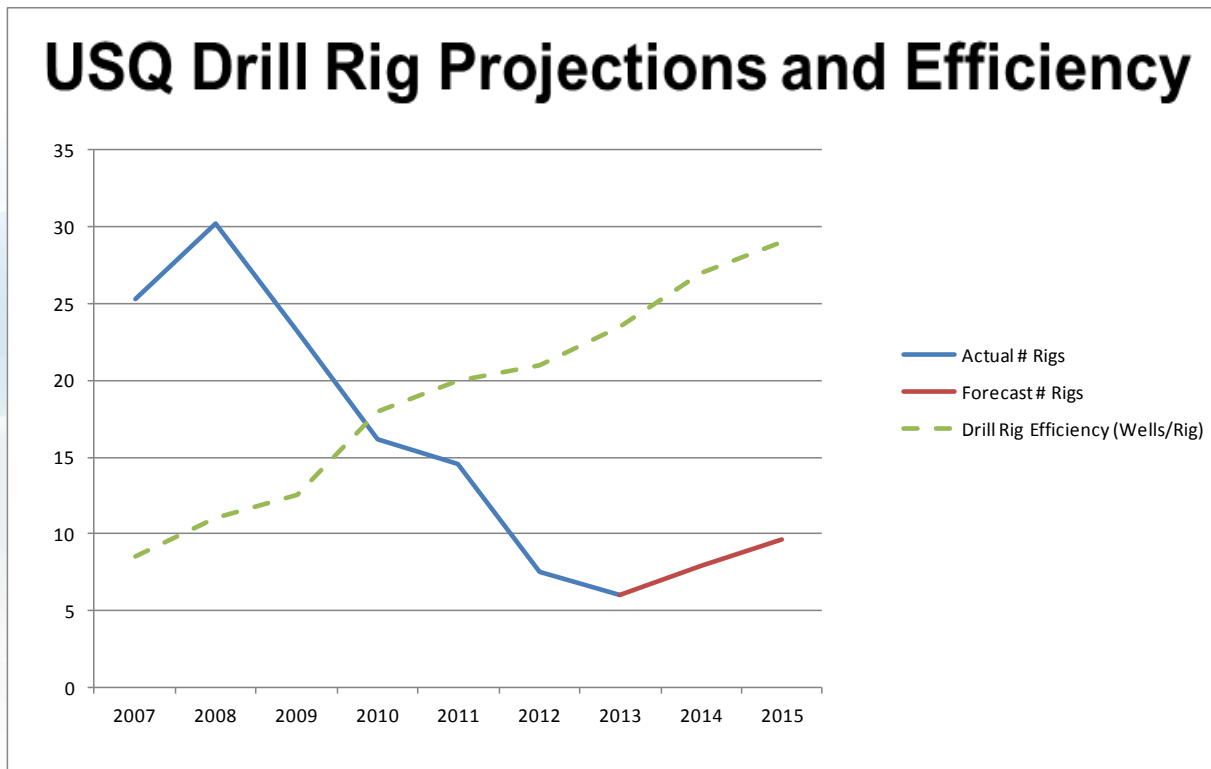
- Newer/lower emission engines
- Installation of Selective Catalyst Reduction (SCRs) on 100% of diesel drill rig engines
- Electrification of natural gas engines
- Installation of low/no bleed pneumatic control devices on equipment
- Voluntarily controlling emissions at grandfathered locations
- Infrared camera inspections to detect leaks so that they can be quickly addressed

Summary of Findings – Emission Reductions

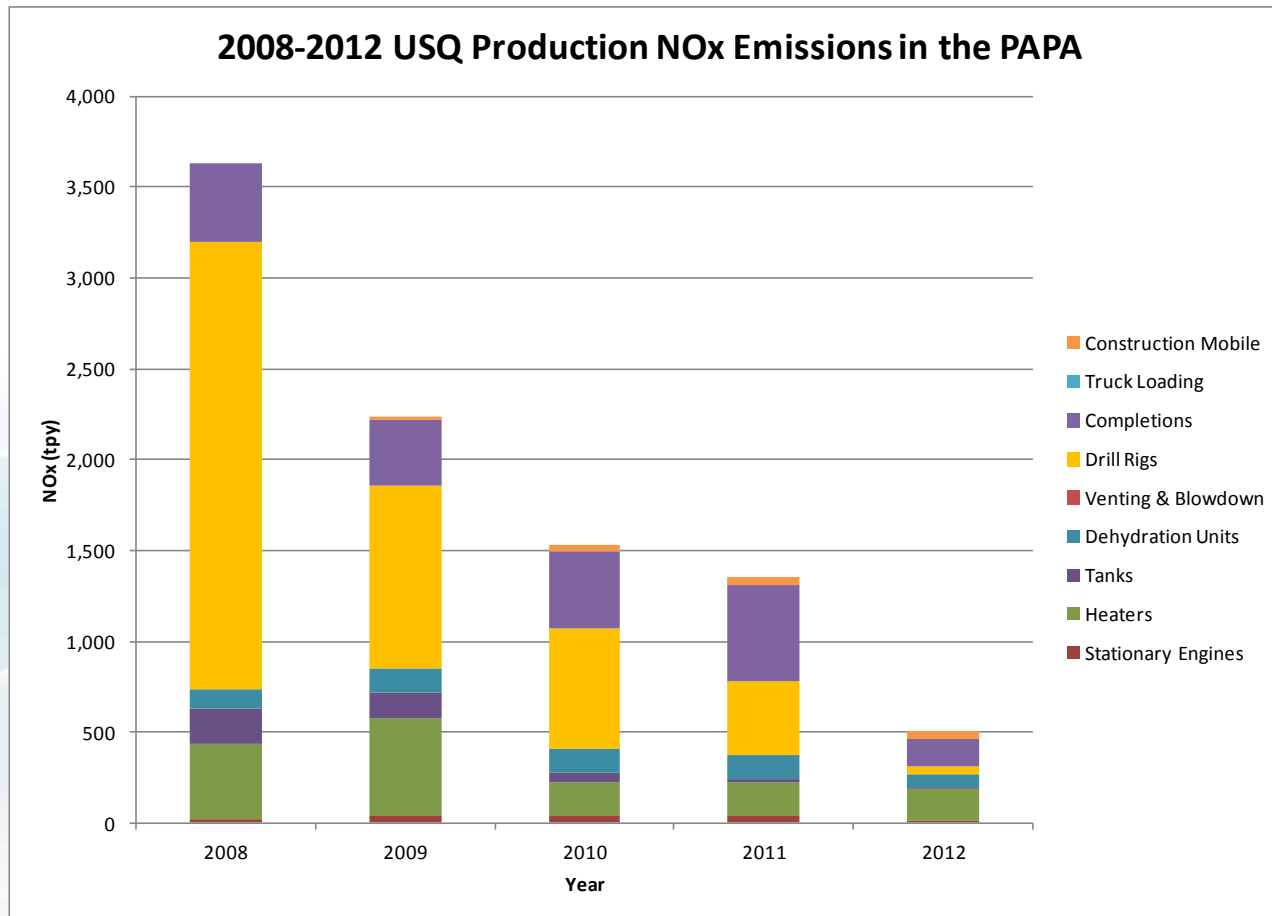
- Installation of a liquids gathering system, which reduces emissions associated with storage tanks, liquids loading, truck traffic, and fugitive emissions
- USQ will reduce their completion NO_x emissions by 10 percent, per ROD visibility Milestone #3
- Conversion of on-road vehicles to natural gas
- More efficient drilling technology, with wells drilled in fewer days using better, low-emission engines

Summary of Findings – Emission Reductions

- Drilling efficiencies have increased by 250%
- SCRs have cut NO_x emissions by >90%

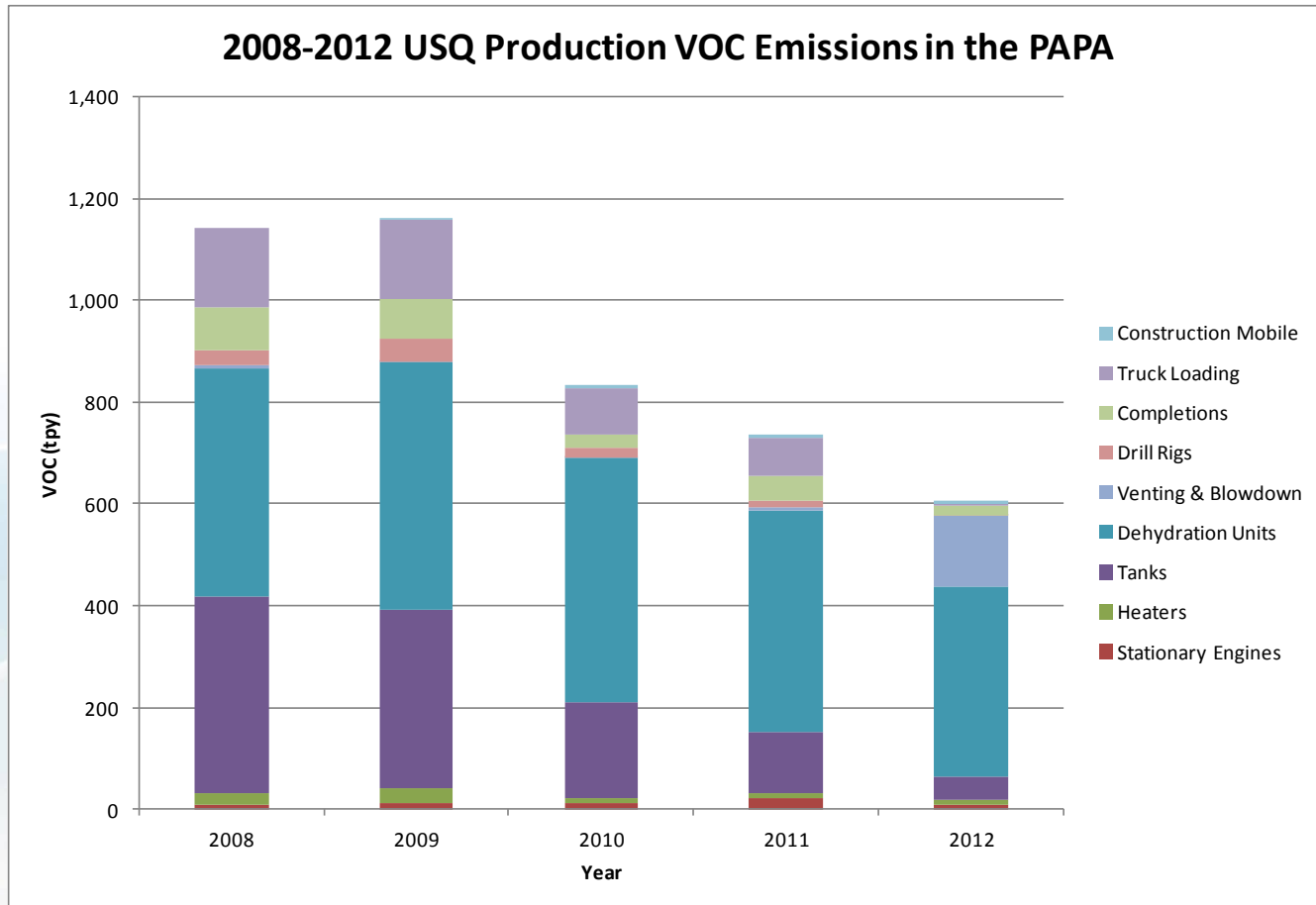


Summary of Findings – Emission Reductions



The chart does not include “pneumatic pumps” or “fugitives”. WDEQ has refined the inventory methodologies for these categories over the years, making year-to-year comparisons less meaningful for these categories.

Summary of Findings – Emission Reductions



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Conclusions

- Section 4.1.2 of the ROD states that the BLM, WDEQ, and the Operators, with input from EPA, will refine the NO_x and VOC emissions inventory
- Since the signing of the ROD in September 2008, the WDEQ has implemented a number of revisions to their annual Operator inventories within the 5-County area
- Sublette County actual emissions of NO_x and VOC have decreased by 75% and 54%, respectively, between 2008 and 2012

Conclusions

- The applicable modeling studies showed that when emissions are reduced, whether it's just NO_x or both NO_x and VOC, the model produces less ozone in Sublette County; these studies demonstrate the sensitivities of CAMx in the UGRB for summer conditions, as required by the ROD
- The WestJump modeling study showed that upstream O&G emissions contribute very little to summer ozone formation

Conclusions

- Background ozone is the driver in the Intermountain West during summer, as stated in the literature and by EPA, and corroborated by the WestJump modeling study
- Summer ozone is formed almost entirely from emissions from uncontrollable background sources outside Sublette County

Next Steps

- A final report will be provided to the BLM and WDEQ by the 4th quarter 2014
- Questions?